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PWS_6000800_CO_20171128_Challenge Study

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

November 28, 2017

Ms. Henia Yacubowicz, Vice President of Technology
Koch Membrane Systems, Inc.
850 Main Street
Wilmington, MA 01887

Re: Koch Membrane Systems Koch Puron® MP Ultrafiltration Membrane Cartridges
Review and Approval of Challenge Testing

Dear Ms. Yacubowicz:

On November 17, 2016, the Texas Commission on Environmental Quality (TCEQ) received a copy of the November 2015 report of the challenge study conducted on the Koch Puron® MP ultrafiltration (UF) membrane modules. This letter addresses the review and approval of the challenge study conducted on the Koch Puron® MP modules. Membrane filtration systems installed on, or replaced after, April 1, 2012 for the removal of *Cryptosporidium* and *Giardia* must undergo challenge testing to evaluate the membrane's removal efficiency and for the TCEQ to establish a challenge test log removal value ($LRV_{C\text{-}Test}$) as required by Title 30 of the Texas Administrative Code (30 TAC) §290.42(g)(3). In addition, these regulations require a membrane manufacturer to provide the non-destructive performance test (NDPT) and associated quality control release value (QCRV) that will be used to verify that all manufactured membrane modules that were not subject to challenge testing will achieve at least the same log removal as those that were challenge tested.

Challenge Study Data for Koch Puron® MP Ultrafiltration Modules

We reviewed the submitted challenge study data for compliance with the *Cryptosporidium* treatment requirements in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The criteria for compliance is found in Title 40 of the Code of Federal Regulations (40 CFR) §141.719(b)(2). Additional guidance for compliance with these requirements can be found in the United States Environmental Protection Agency (USEPA) Membrane Filtration Guidance Manual (EPA 815-R-06-009). The TCEQ reviewed challenge study data presented in *California Division of Drinking Water Conditional Acceptance Testing for Koch Puron® MP Membrane*, prepared by MWH Americas, Inc. (November 2015). Based on our review, we have determined that the challenge study is compliant with LT2ESWTR requirements. Please review the following in regards to the approved log removal value demonstrated during challenge testing ($LRV_{C\text{-}Test}$) and the non-destructive performance test (NDPT) for production membrane modules that did not undergo challenge testing.

TCEQ Approved $LRV_{C\text{-}Test}$

The TCEQ is approving a **$LRV_{C\text{-}Test}$ of 5.6** for the removal of *Cryptosporidium* for the Koch Membrane Systems Koch Puron® MP membrane modules. The following are the parameters of the approved challenge study:

Full-scale Module Tested	Koch Membrane Systems Puron® MP 8081-102 Module
Number of Independent Modules Tested	2
Criterion of Selected Modules[1]	Full-Scale Modules intentionally compromised and exceeding (do not pass) the Quality Control Release Value (QCRV) in accordance with California Department of Public Health Requirements
Serial Numbers of Tested Modules	KM8032294-5002 and KM8032294-5003
Nondestructive Performance Testing (NDPT) Process	Pressure Decay Test
Quality Control Release Value (QCRV)	Max. Allowable Pressure Decay Rate of 0.12 psi/min with Hold-up Volume of 17.0 liters and a starting test pressure of 13.0 psi
Challenge Particulate	0.5 µm Fluorescent Latex Spheres (as a surrogate for *Cryptosporidium*)
Detection Limit	10 objects per unit volume
Feed Concentration Range	1.9×10^7 particles per liter (L) to 3.3×10^7 particles per L
Challenge Test Flux Rate	80 gallons per square-foot per day (gfd) at 20° C
Mode of Operation / Flow Configuration	Direct Filtration (Deposition Mode) / Outside In

[1]The criterion for selection of piloted membranes is provided in Appendix A, Section 3.1.1 of the *California Division of Drinking Water Conditional Acceptance Testing for Koch Puron® MP Membrane*, prepared by MWH Americas, Inc. (November 2015).

LIMITS OF TCEQ APPROVED $LRV_{C\text{-}Test}$

The TCEQ-approved $LRV_{C\text{-}Test}$ is only valid for the Koch Puron® MP hollow-fiber cartridge UF membrane modules operated under the parameters that were used for the challenge testing and only for modules that have passed the NDPT. From our review of the challenge study, an acceptable Koch Puron® MP membrane module must comply with the following to receive the approved $LRV_{C\text{-}Test}$:

1) Specifications of the approved Koch Puron® MP modules:
   a) Constructed of proprietary semi-permeable polyvinylidene fluoride (PVDF) polymer hollow-fiber membranes;
   b) Active membrane surface area - 546 square-feet (ft^2);
   c) An average liquid-membrane contact angle ranging from 57.3 to 58.6 degrees;
   d) Membrane charge- slightly negative;
   e) Membrane surface characteristics- hydrophillic:
   f) A nominal pore size of 0.03 microns;
   g) An Outside-In flow path;
   h) Operated in direct filtration (deposition mode);
   i) Design flux rate of 80 gfd;
   j) Maximum operating temperature of 40°C;
   k) Maximum transmembrane pressure of 45 pounds per square-inch (psi);
   l) A pH operating range of 1.8 to 10.5 (long-term operation);
   m) Allowable pH range for cleaning of 1.8 to 10.5; and
   n) Maximum chlorine tolerance of 500,000 parts per million (ppm) hours.

2) Each Koch Puron® MP membrane module used by public water systems in Texas for microbial contaminant removal credit must be certified by an organization accredited by the American National Standards Institute (ANSI) to NSF/ANSI Standard 61 (Drinking Water System Components). We note that the Koch Puron® MP membrane modules produced at

the Koch's Wilmington, MA facility had NSF/ANSI Standard 61 and NSF/ANSI Standard 372 (Lead Content Certification) certification from Underwriter's Laboratories (UL) during 2014, based on the provided Koch Puron® MP specification within the challenge study. In addition, based on the UL's online certification link, Koch Puron® MP membranes are certified to NSF/ANSI 61 and for lead content for products in contact with potable water as of November 3, 2017, when UL last provided updates.

3) Prior to shipment to a Texas public water system, each new Koch Puron® MP membrane module must have passed the manufacturer's NDPT with a minimum starting pressure of 13 psi, a hold-up volume of 17 liters, and a maximum allowable decay rate of 0.12 psi per minute.

4) All Koch Puron® MP membrane modules installed at a Texas public water system for microbial contaminant removal credit must have passed the NDPT as described above.

5) Koch Membrane Systems must notify the TCEQ in writing if the Koch Puron® MP membrane modules as challenge tested by MWH Americas, Inc. are modified or the NDPT method is modified in any manner. After receiving written notification, the TCEQ will determine if the modified Koch Puron® MP membrane module shall be required to undergo challenge testing or if the modified NDPT method is acceptable.

6) The TCEQ will grant Texas public water systems using membrane filtration log removal credits for *Giardia* and *Cryptosporidium* that shall not exceed the lower of:
   a) The TCEQ approved $LRV_{C\text{-}Test}$; and
   b) The maximum removal efficiency that can be verified through a membrane unit's site-specific direct integrity test (LRV_{DIT}).

7) Please note that the approved $LRV_{C\text{-}Test}$ is based on current Federal and Texas statutes and EPA and TCEQ rules. If any of these statutes or rules are revised, the TCEQ approved $LRV_{C\text{-}Test}$ in this letter may also be revised.

Please provide a copy of this letter to each of your Texas public water system customers and their consulting engineers. This letter is **not** to be construed as:

- A TCEQ granted exception for any Texas public water system to use the Koch Puron® MP membranes. Each Texas public water system must request and receive site-specific approval to use membrane filtration in accordance with 30 TAC §290.42(g) and §290.39(l);

- TCEQ approval for a Texas public water system to install Koch Puron® MP membranes; or

- TCEQ approval for a Texas public water system's required concentration time (CT) study.

If you have questions concerning this letter, or if we can be of additional assistance, please contact Jennifer K. Dorsey, P.E. at the letterhead address, by e-mail at jennifer.dorsey@tceq.texas.gov, or by telephone at (512) 239-4635.

Sincerely,

Jennifer K. Dorsey

Jennifer K. Dorsey, P.E.
Technical Review and Oversight Team
Plan and Technical Review Section
Texas Commission on Environmental Quality

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JPK/JKD